Catalogue of American Amphibians and Reptiles.

DUELLMAN, WILLIAM E., AND RONALD I. CROMBIE. 1970. *Hyla septentrionalis.*

Hyla septentrionalis Duméril and Bibron Cuban treefrog

Trachycephalus marmoratus Duméril and Bibron, 1841:538. Type locality, "Cuba.' Holotype, Musée National d'Historie Naturelle, Paris, 4612, adult female, donated by Ramon de la Sagra and Henri Delaroche (examined by senior author). Preoccupied by *Hyla marmorata* (Laurenti), 1768:29.

Hyla septentrionalis Duméril and Bibron, 1841:538. Substitute name for *Trachycephalus marmoratus* (see Nomenclatural History).

Trachycephalus insulsus Cope, 1863:43. Type locality, "Cuba." Syntypes, U. S. Natl. Mus. 12166 (adult male) and 167237 (adult female), formerly USNM 6266, collected by Felipe Poey (examined by junior author) (see Comment).

Trachycephalus wrighti Cope, 1863:45. Type locality, "District of Guantanamo, southeastern Cuba" (Oriente Province). Holotype, U. S. Natl. Mus. 5174, adult female, collected by Charles Wright (examined by authors).

Hyla schebestana Werner, 1917:36. Type locality, "Cuba." Holotype, formerly Zool. Mus. Hamburg (no number), adult female, donated by "Herrn Apotheker Sebesta" (presumably destroyed in World War II; not seen by authors).

Hyla septentrionalis septentrionalis: Barbour, 1937:94. First use of the trinomial.

Hyla dominicensis septentrionalis: Mertens, 1938:333. Nomenclatural correction of Barbour's (1937:94) use of the trinomial.

Hyla dominicensis insulsa: Mittleman, 1950b:26. New combination (see Nomenclatural History).

Hyla dominicensis: Peterson, Garrett, and Lantz, 1952:63. No subspecific designation (see Nomenclatural History).

Hyla insulsa: Jaume, 1966:15. New combination (see Nomenclatural History).

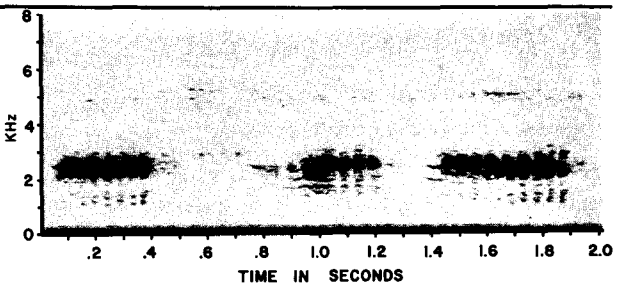
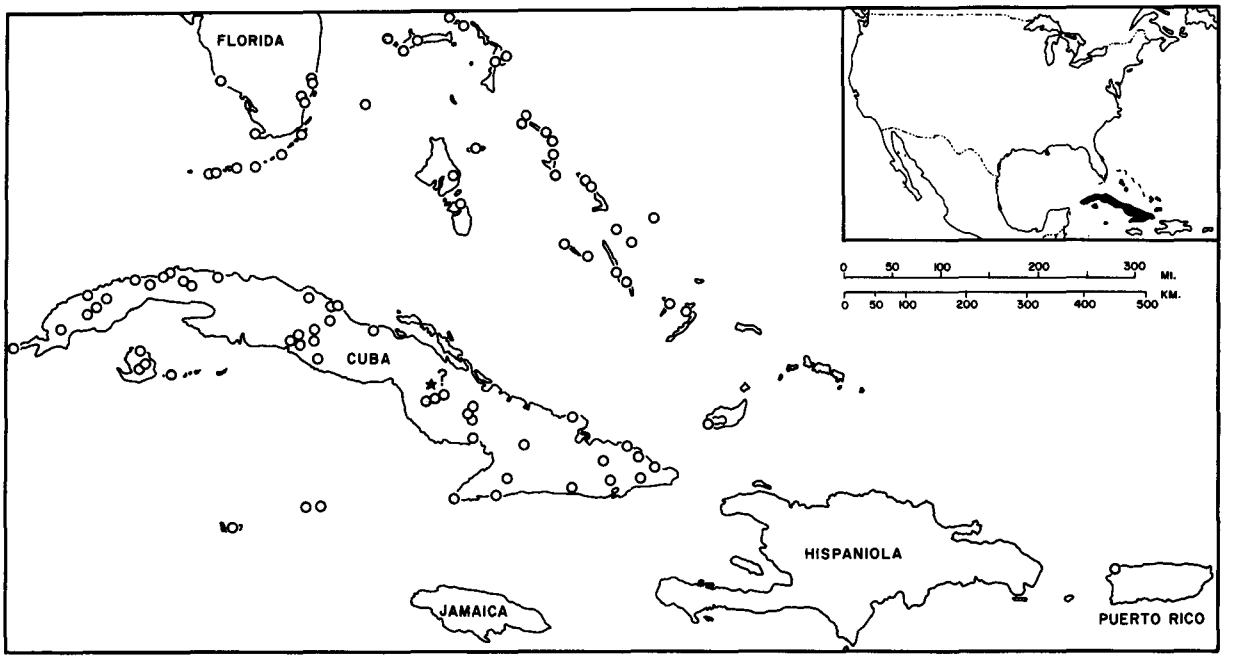


FIGURE. Audiospectrogram (narrow band, 45 Hz) of call of *Hyla septentrionalis*: San Vicente, Pinar del Rio, Cuba, 19 June 1957, 25°C (Amer. Mus. Nat. Hist. Dept. Herpetology tape library, recorded by Albert Schwartz).

• CONTENT. No subspecies are recognized.

• DEFINITION. A large *Hyla* — males attain snout-vent lengths of 62 mm, and females reach a length of 97 mm. The head is broad, and the nostrils are not terminal on the truncate snout. The skin on the top of the head is co-ossified with the underlying cranial elements. The tympanum is large; a distinct tarsal fold extends the full length of the tarsus. The fingers are webbed basally, and the toes are about two-thirds webbed. The skin on the dorsum is usually tuberculate; that on the venter is granular. Breeding males have horny nuptial excrescences on the thumbs and a median internal subgular vocal sac with posterolateral extensions. The skull is broad and well ossified; the nasals are large and in contact medially anterior to the large dermal sphenethmoid. The frontoparietals, nasals, sphenethmoid, and partes fasciales of the maxillaries are involved in the integumentary-cranial coossification. The frontoparietals are expanded laterally, forming a shelf above the otic region. The squamosal is massive, but the anterior arm is not in contact with the maxillary. The quadratojugal is present and firmly articulated with the maxillary. The dentigerous processes of the prevomers are long and curved. In life the dorsal ground color is pale green, ashy gray, pale brown, or reddish brown. Dorsal markings consisting of bold reticulations or elongate blotches on the



MAP. Circles indicate locality records; there is no restricted type-locality other than "Cuba." The star indicates a presumed but questionably fossil record.

back and transverse bars on the limbs are usually evident. The markings are dark gray, dark olive green, or deep brown. The flanks, posterior surfaces of the thighs, and the axillary areas are cream or yellow with dark brown or black reticulations; on the thighs the reticulations tend to enclose small cream spots. The ventral surfaces are creamy white; in males the throat is often suffused with gray.

Tadpoles have an ovoid body; the spiracle is sinistral, and the vent is dextral. The pointed tail is about twice the length of the body. The caudal musculature is slender and does not extend to the tip of the tail. At midlength of the tail the depth of the caudal musculature is noticeably less than the depth of either fin. The dorsal fin extends onto the body. The anteroventral mouth is moderately small; the lips are infolded laterally. One row of labial papillae is present laterally and ventrally; the upper lip is bare. There are two upper and four lower rows of teeth; the second upper and first lower rows are interrupted medially, whereas the other rows are complete. The body is black, and the caudal musculature is grayish brown; the fins are transparent with scattered melanophores.

The presence of integumentary-cranial co-ossification immediately distinguishes adult *Hyla septentrionalis* from other hylids in the southeastern United States. Juvenile *septentrionalis*, however, are frequently confused with *Hyla squirella* in areas of sympatry. Small *septentrionalis* often show no sign of dermal co-ossification, but may be distinguished from *squirella* by several identifying characters. Adult *squirella* have rounded patches of vomerine teeth, no finger webbing, a rounded canthus rostralis, and a smooth dorsum, whereas *septentrionalis* of similar size have transverse vomerine series, slight but distinct finger webbing, a well defined canthal ridge, and sparse dorsal tuberculation. Adult *Hyla septentrionalis* are most easily confused with the Hispaniolan *Hyla dominicensis* and the Jamaican *Hyla brunnea*. The latter differs from *Hyla septentrionalis* by having the skin on the dorsum smooth, the snout somewhat protruding with terminal nostrils, and the dorsal coloration of dark brown spots or large blotches on a paler brown ground color. *Hyla dominicensis* is like *septentrionalis* in most morphological features, but the skin on the dorsum is generally smooth; tubercles are present on the legs of some specimens. The coloration is similar to that of *septentrionalis* but apparently is confined to shades of brown in life; the ventral surfaces of the legs are often spotted with brown.

• DESCRIPTIONS. Many references mention characteristics of *Hyla septentrionalis*, but the most useful are Barbour and Ramsden (1919), Carr (1940), Wright and Wright (1949), Carr and Goin (1955), Conant (1958), and Duellman and Schwartz (1958). The latter authors provided a brief discussion of variation in Floridian populations and described the tadpoles. The details of the integumentary-cranial co-ossification were pointed out by Trueb (1966), who described the skull and its development. Blair (1959) described the call, based on a single recording, as: "A sequence of calls consisting of two structurally different sounds may be given at intervals of about 0.9 second. The first of these has a fundamental of about 300 cps and a series of harmonics up to about 5100 cps. The frequency rises and falls in a variable pattern, and the dominant frequency rises from about 2100 cps at the start to 2500 at the end. This element lasts about 0.15 second and is followed by a pulsed section about 0.30 to 0.40 second long. From five to nine pulses occur at a rate of 25 to 40 per second. The fundamental of this section is about 150 cps and has a long series of harmonics. In some sequences there is also a slowly pulsed element consisting of five pulses, each about 0.03 second in length and given at a rate of about 10 per second. The fundamental is about 105 cps, and the expressed harmonics are mostly between 945 and 2560 cps."

• ILLUSTRATIONS. Colored illustrations are given in Conant (1958) and Cochran (1961); black and white illustrations are to be found in Barbour and Ramsden (1919), Wright and Wright (1949), Carr and Goin (1955), Duellman and Bell (1955), Duellman and Schwartz (1958), Cochran (1961), and Porter (1962, 1967). Duellman and Schwartz (1958) illustrated the tadpole; Trueb (1966, 1970) provided illustrations of the cranial morphology. Blair (1958) published an audiospectrogram.

• DISTRIBUTION. *Hyla septentrionalis* occurs at low and moderate elevations throughout Cuba. The species also occurs on the Cayman Islands (Grand Cayman, Little Cayman, and Cayman Brac) and on many of the Bahama Islands, where it is found on the islands of the Little Bahama Bank, Grand Bahama Bank, San Salvador, Rum, Crooked, and Acklin's islands, all to the northwest of the Mayaguana Passage. Schwartz (1968) noted the introduction of the species on Great Inagua Island. *Hyla septentrionalis* was first reported from the United States on Key West, Florida, by Barbour (1931). The species was subsequently reported from Stock Island and Upper Matecumbe Key (Trapido, 1947), Key Vaca (Peterson, Garrett, and Lantz, 1952), Miami (Schwartz, 1952), Key Largo, Big Pine Key, and introduced by man at Royal Palm Hammock (= Paradise Key) (Allen and Neill, 1953). Duellman and Schwartz (1958) noted the apparent absence of the species at Paradise Key. In Florida the species is now known from several of the islands of both the upper and lower keys, from various localities on the east coast of the mainland from Cape Sable, Monroe County, to the Broward-Palm Beach County line (Lee, 1969), and from Naples, Collier County, on the west coast. Albert Schwartz (personal communication) has obtained the species at Ramsey Air Force Base, Puerto Rico, where it certainly is introduced. Barbour (1931) implied that *Hyla septentrionalis* was introduced by man on Key West, although he stated that residents of the island had always known the frogs there. The possible salt tolerance of this frog, as reported by Peterson *et al.* (1952) and Neill (1958), combined with its wide insular distribution in the Bahamas, lends credence to the supposition that the species is capable of dispersal across salt water barriers and that its presence in Florida, at least on the keys is the result of natural dispersal.

• FOSSIL RECORD. Koopman and Ruibal (1955), in reporting fossil finds from two caves in northern Camaguey mention that, "Cranial and postcranial elements of this common tree frog were the most abundant non-mammalian remains to be found in Cave 1 and Cave 2." Some of these bones appeared larger and more rugged than their recent comparative material. They noted, however, that the deposits were greatly disturbed by diggings for bat guano, and that the establishment of an accurate relative age for the material would be impossible.

• PERTINENT LITERATURE. The most complete accounts of the habits, habitat, and behavior of *Hyla septentrionalis* in the United States are those of Carr (1940), Wright and Wright (1949), and Duellman and Schwartz (1958); the latter authors and Carr (1940) provided information on the food habits, Mittleman (1950a) and Peterson, Garrett, and Lantz (1952) reported field observations; Lantz (1952) noted burrowing behaviour in captive individuals. Zajicek and Mauri Mendez (1969) mentioned Cuban specimens parasitized by sporozoans of the genus *Lankesterella*; Goin and Jackson (1965) reported on the hemoglobin values. Trueb (1966, 1970) reported detailed observations on the cranial osteology, and Goin, Goin, and Bachmann (1968) commented on the low nuclear DNA values of this species. Barbour (1937) discussed the taxonomy of insular populations and concluded that *Hyla septentrionalis* should be considered subspecifically related to the Hispaniolan *Hyla dominicensis* and the Jamaican *Hyla brunnea*. Myers (1950) objected to the subspecific arrangement, elevated *septentrionalis* to specific status, and clarified the authority for the name. Trueb (1970) provided support for Myers' taxonomic arrangement by demonstrating differences among the three species.

• NOMENCLATURAL HISTORY. The determination of the authority for the name *Hyla septentrionalis* has had a long

and confusing history. Stejneger (1905) concluded that Schlegel's (1837) *Hyla septentrionalis* and Tschudi's (1838) *Dendrohyas septentrionalis* were *nomina nuda*; Stejneger credited the name to Boulenger (1882) and he was followed by most writers, even though Cope (1863) had provided two names for the same species. Mittleman (1950b) referred *Hyla septentrionalis* Schlegel, a *nomen nudum*, to the synonymy of *Hyla chalconota* Schlegel and revived Cope's trivial name *insulsa* for populations previously known as *Hyla septentrionalis*; he considered *insulsa* to be a subspecies of *Hyla dominicensis*. Myers (1950) disagreed with Mittleman, gave a detailed discussion of the problem, and concluded that: (1) both Schlegel and Tschudi used a manuscript name (*Hyla septentrionalis*) of Duméril and Bibron, which the latter had designated on the erroneous assumption that the specimens had come from "Nordkap," Norway, (2) the inclusion of *Hyla septentrionalis* in the synonymy of *Trachycephalus marmoratus* by Duméril and Bibron (1841) in their description of the species is indicative that they considered Schlegel's and Tschudi's usage of the name *septentrionalis* to be equal to their *Trachycephalus marmoratus*, (3) the inclusion of *marmoratus* Duméril and Bibron in the genus *Hyla* resulted in that name becoming a junior homonym of *Bufo* (*Hyla*) *marmorata* Laurenti (1768), thereby making *marmoratus* Duméril and Bibron unavailable, (4) the next available name is *Hyla septentrionalis* Duméril and Bibron, as published in the synonymy of *Trachycephalus marmoratus*. Most subsequent authors have used the trivial name *septentrionalis*, although some have erroneously cited Boulenger as the authority. Jaume (1966), however, followed Mittleman in the use of the name *insulsa*, but regarded it as a distinct species; this resulted in the combination *Hyla insulsa*. Peterson, Garrett, and Lantz (1952) and Lantz (1952) are other notable exceptions; they used *Hyla dominicensis* for Floridian specimens.

• Remarks. Mittleman (1950a) reported a male skeleton from Key West having a length of 112 mm from the "anterior edges of the premaxillae to the posterior extremity of the ischium." This size is far larger than otherwise reported for females, and needs to be verified.

• Etymology. The specific name is Latin, meaning "of the Septentriones," signifying "of the north," and was applied to the types by Duméril and Bibron at a time when they were under the impression that the specimens had originated from Norway (see Myers, 1950).

Comment

The taxonomic recognition of insular populations is a philosophical problem that faces all workers involved with insular faunas. Prior to 1937 *Hyla septentrionalis* was accorded specific status. Barbour (1937), in an expression of his philosophy of the taxonomy of insular populations, considered *brunnea*, *dominicensis*, and *septentrionalis* to be subspecifically related; he provided no data to substantiate his arrangement. Myers (1950), mostly on data provided by Dunn (1926) and Noble (1927), gave evidence that the three taxa are specifically distinct. Although in size and structure the three species are similar, there are some constant differences among them. *Hyla brunnea* is the most distinctive in external features. Furthermore, as noted by Trueb (1970), the skull is noticeably different from those of *dominicensis* and *septentrionalis*. The tadpoles of *brunnea* have reduced mouthparts and develop in bromeliads (Dunn, 1926), whereas the tadpoles of *dominicensis* and *septentrionalis* have a full complement of mouthparts and develop in ponds or streams.

The external differences between *dominicensis* and *septentrionalis* are slight and consist of the absence of green in the dorsal coloration, reduced dorsal tuberculation, slightly longer legs, and more extensive finger webbing in *dominicensis*. Trueb (1970) noted minor cranial differences between the two species. Albert Schwartz (personal communication) stated that he can distinguish between the calls of the two species. Thus, on the basis of the accumulating evidence on morphology, life history, and behaviour, each of the three taxa is given specific recognition.

Hyla septentrionalis and its West Indian relatives are not members of the genus *Trachycephalus*, a group of four South American species characterized by casqued heads with extensive integumentary-cranial co-ossification and paired lateral vocal sacs behind the angles of the jaws. Trueb (1970) defined *Trachycephalus* and the *Hyla septentrionalis* group on the basis of cranial characters and suggested that the *septentrionalis* group was related to the South American *Hyla boans* group.

Cope (1863) described *Trachycephalus insulsus* from four specimens originally numbered U. S. Natl. Mus. 6265 (2) and 6266 (2). Barbour (1914) was unable to find these syntypes and presumed them lost. The National Museum catalogue notes that the two specimens assigned to 6265 were "destroyed" around 1880. They presumably macerated in the bottle; in the process, the numbers on the other two specimens (6266) were obliterated. These were later recatalogued as USNM 12166 and not recognized as types, resulting in the situation as Barbour found it in 1914. These specimens were recently rediscovered by the junior author; one syntype, the male, remains USNM 12166, and the female has been recatalogued as USNM 167237.

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Published 11 September 1970 by the American Society of Ichthyologists and Herpetologists. Publication is supported by National Science Foundation grant G24231.

Primary editor for this account, Richard G. Zweifel.